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Safe & SuRe Decision Support Tool

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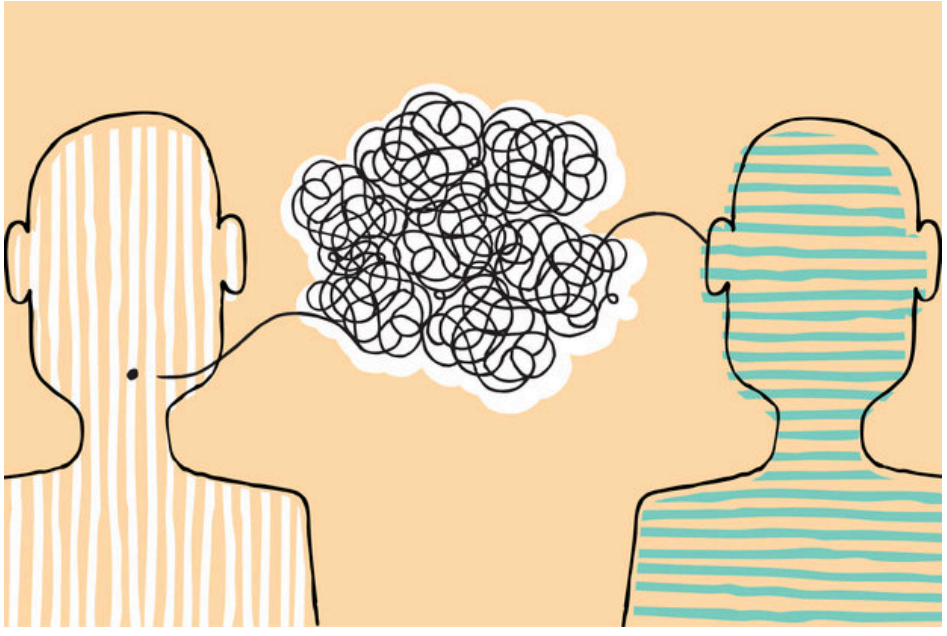
Scottish Water
Trusted to serve Scotland

Context



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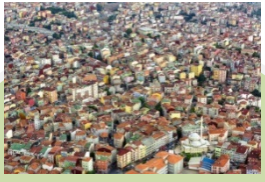
What is Safe & SuRe water management?

Safe: *Reliable*
SuRe: *Sustainable and Resilient*

Aim of the S&S research project: To develop a new paradigm for 'Safe & SuRe' urban water management in the UK in response to emerging challenges and global uncertainties

S&S Interventions Framework

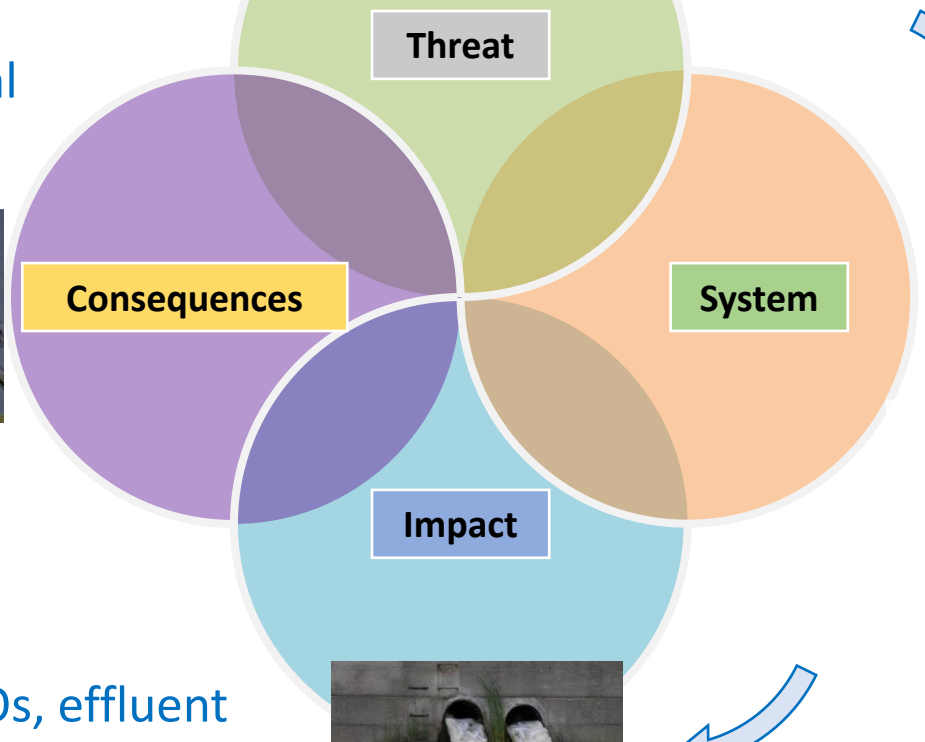


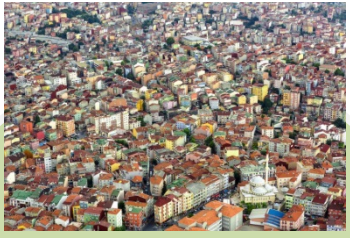
E.g. Urbanisation

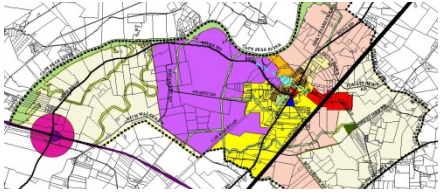
Environmental damage,…

Increased system influent

CSOs, effluent quality failure, …



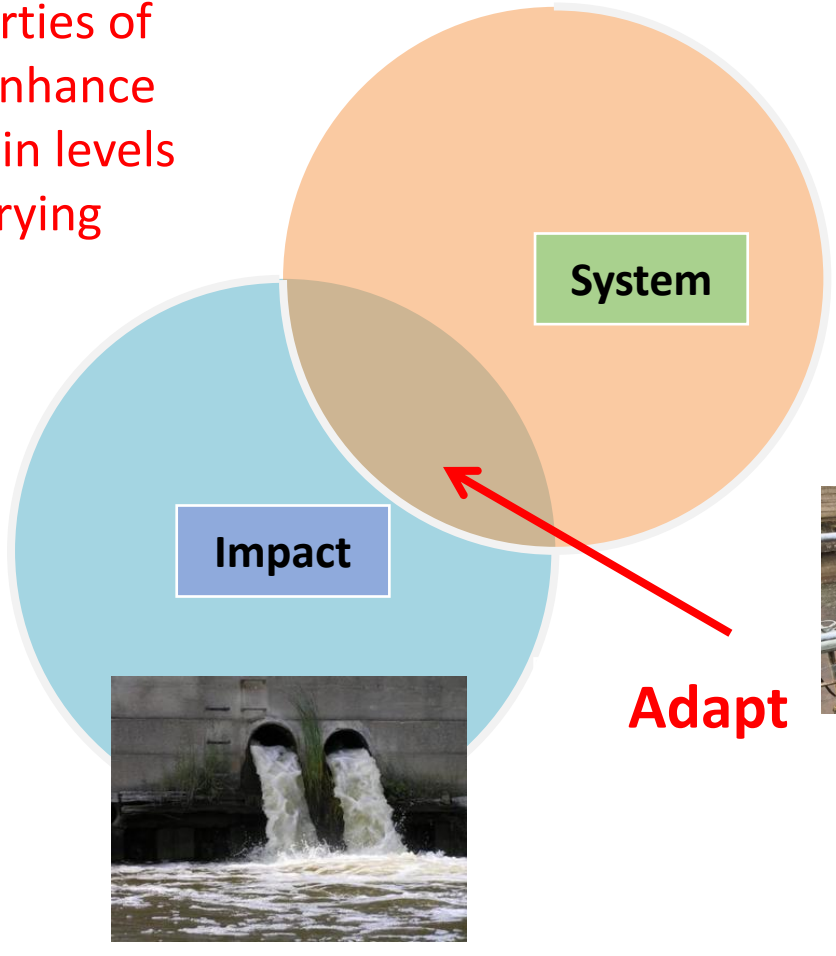


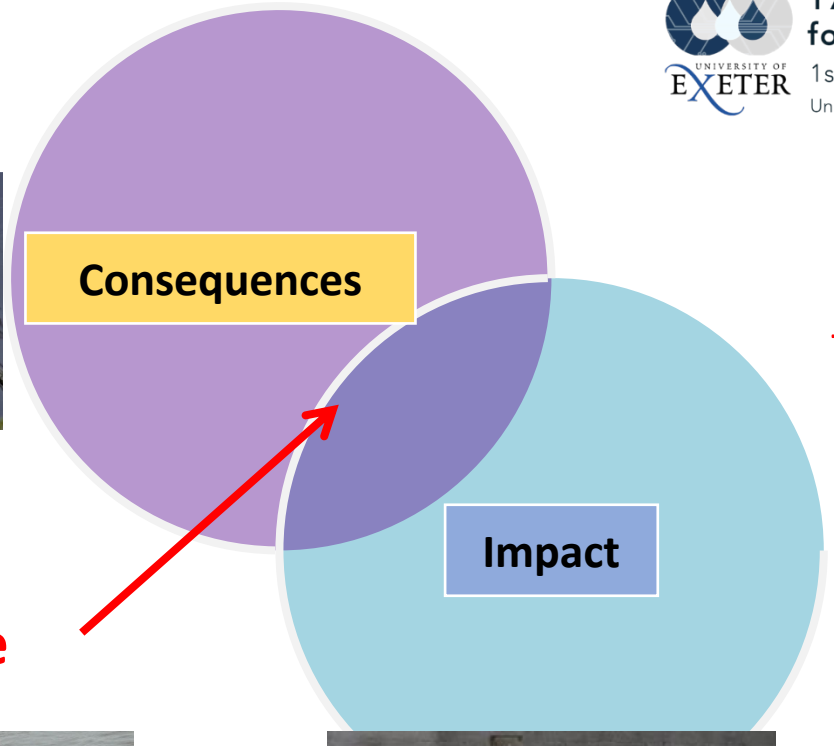


Mitigate

Mitigation: 'Any physical or non-physical action taken to reduce the frequency, magnitude or duration of a threat'

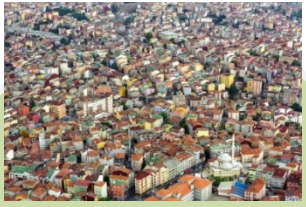
Adaptation: 'Action taken to modify specific properties of the water system to enhance its capability to maintain levels of service under varying conditions'

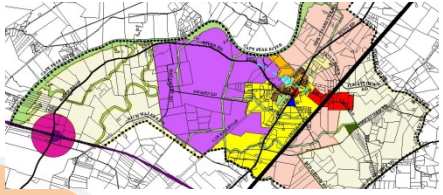




Coping: 'Any preparation or action taken to reduce the frequency, magnitude or duration of an impact on a recipient'

Learning: 'Embedding experiences and new knowledge in best practice'





Threat

Learn

Mitigate

Consequences

System

Cope

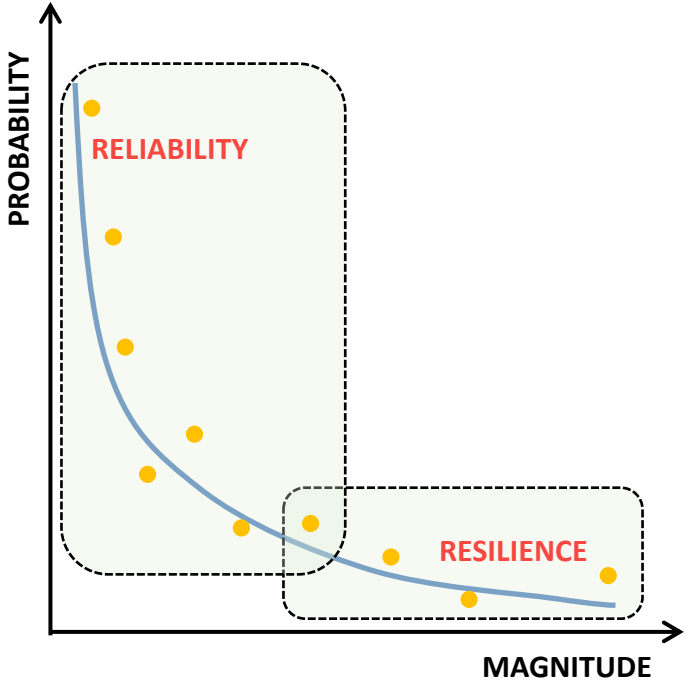
Adapt

Impact

Scottish Water
Trusted to serve Scotland

Trusted to care for the water on which Scotland depends

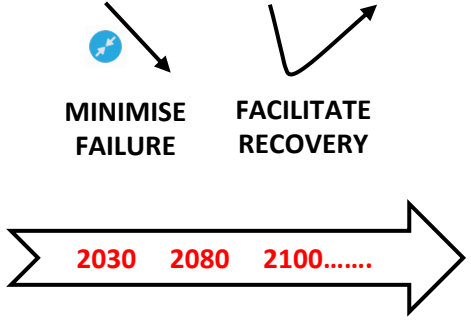
Trusted to serve Scotland



Serving
We delight our customers by showing that we care

Responsible
We always do the right thing for Scotland

Leading
We shape our future for the benefit of our customers



System

Impact

Consequences

CUSTOMER

COLLECTION & REMOVAL

Loss of drainage service in the event of extreme flooding

Customer flooding

NETWORK

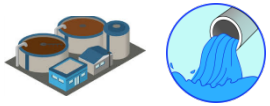
CONVEYANCE

Loss of drainage service in the event of asset failure within the network

Customer flooding/ environmental pollution

TREATMENT

TREATMENT & DISPOSAL



Treatment processes unable to deliver compliant discharges

Environmental pollution

HAZARD

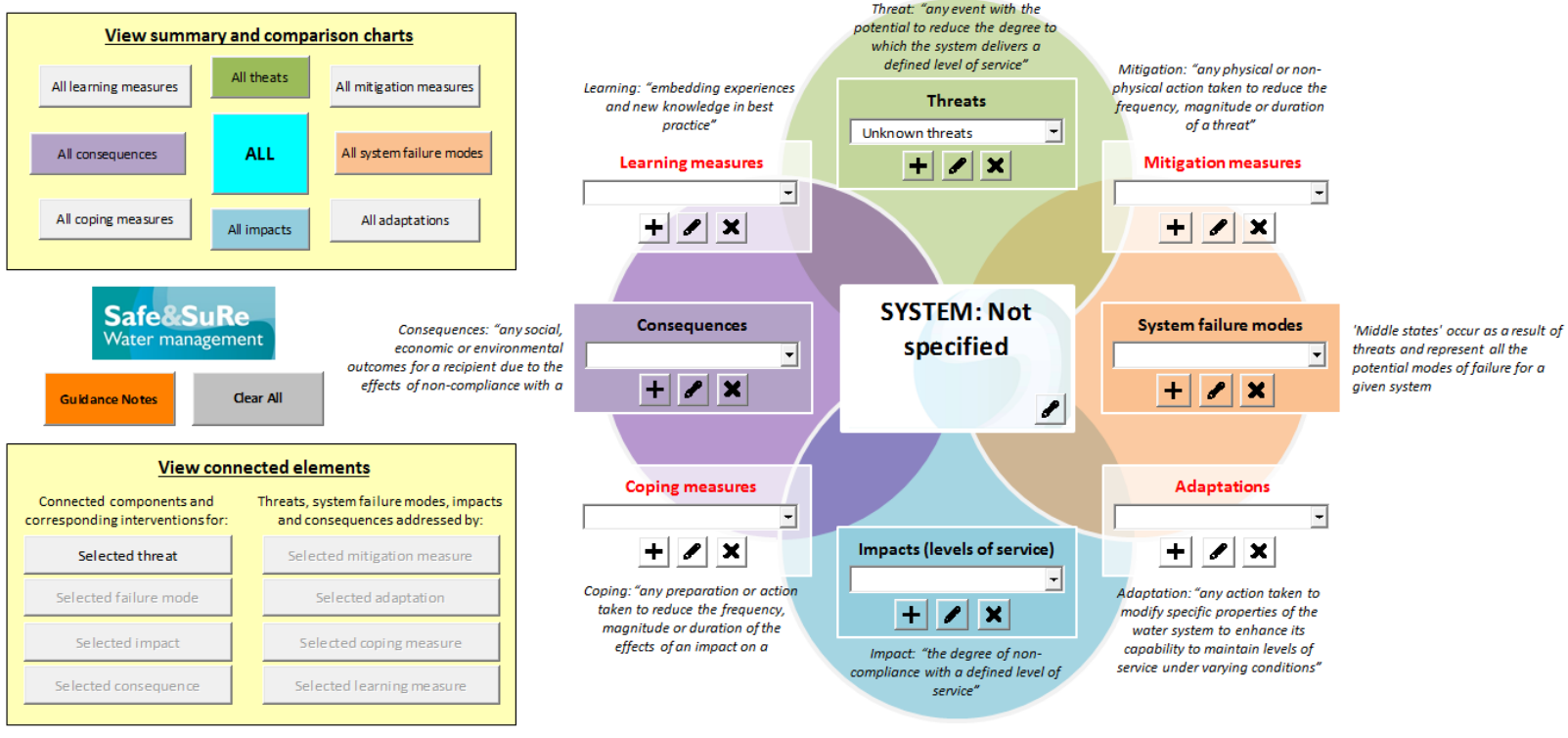
Asset operability, service continuity

Customer flooding/ environmental pollution

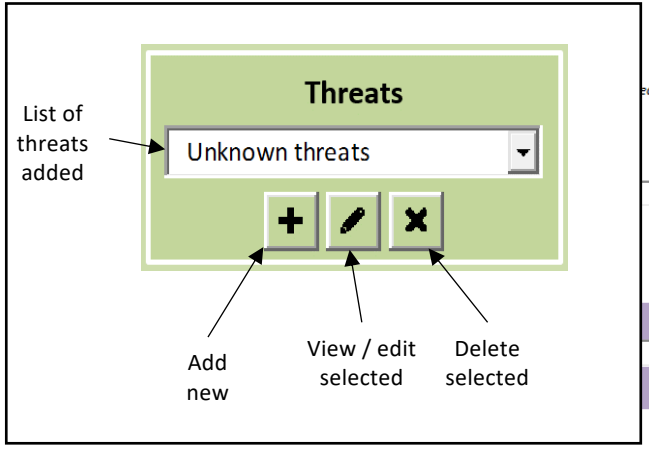
Threat

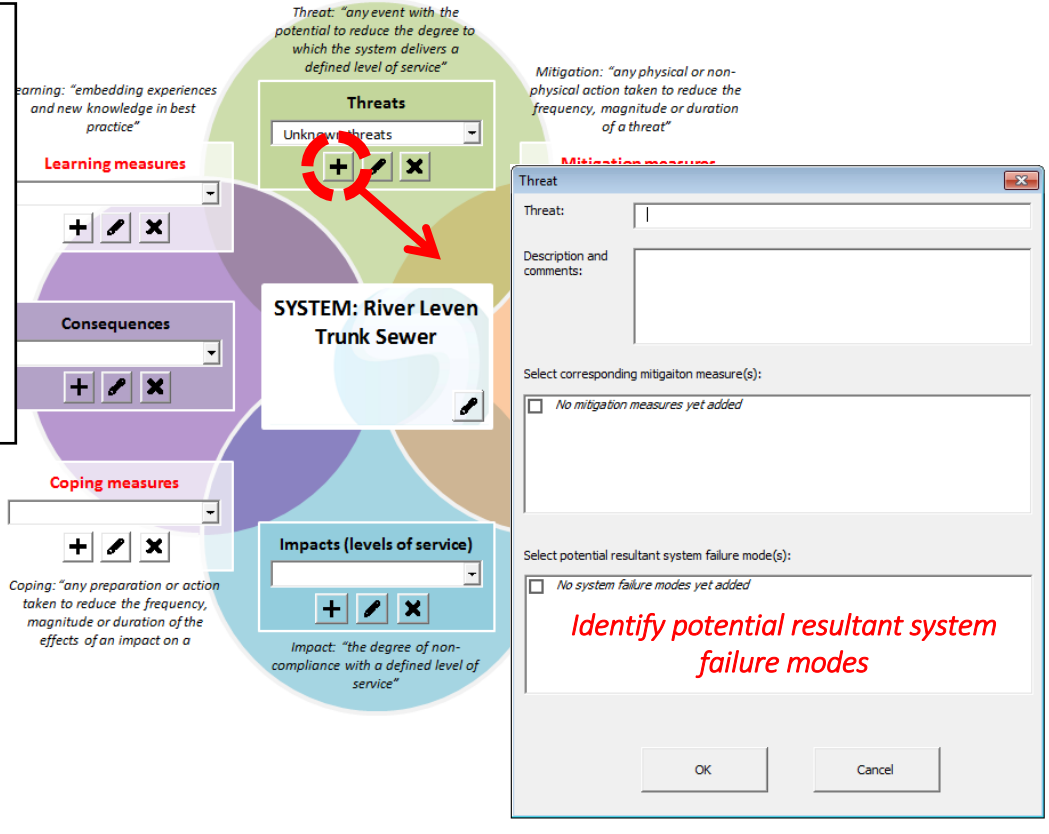
Decision support tool

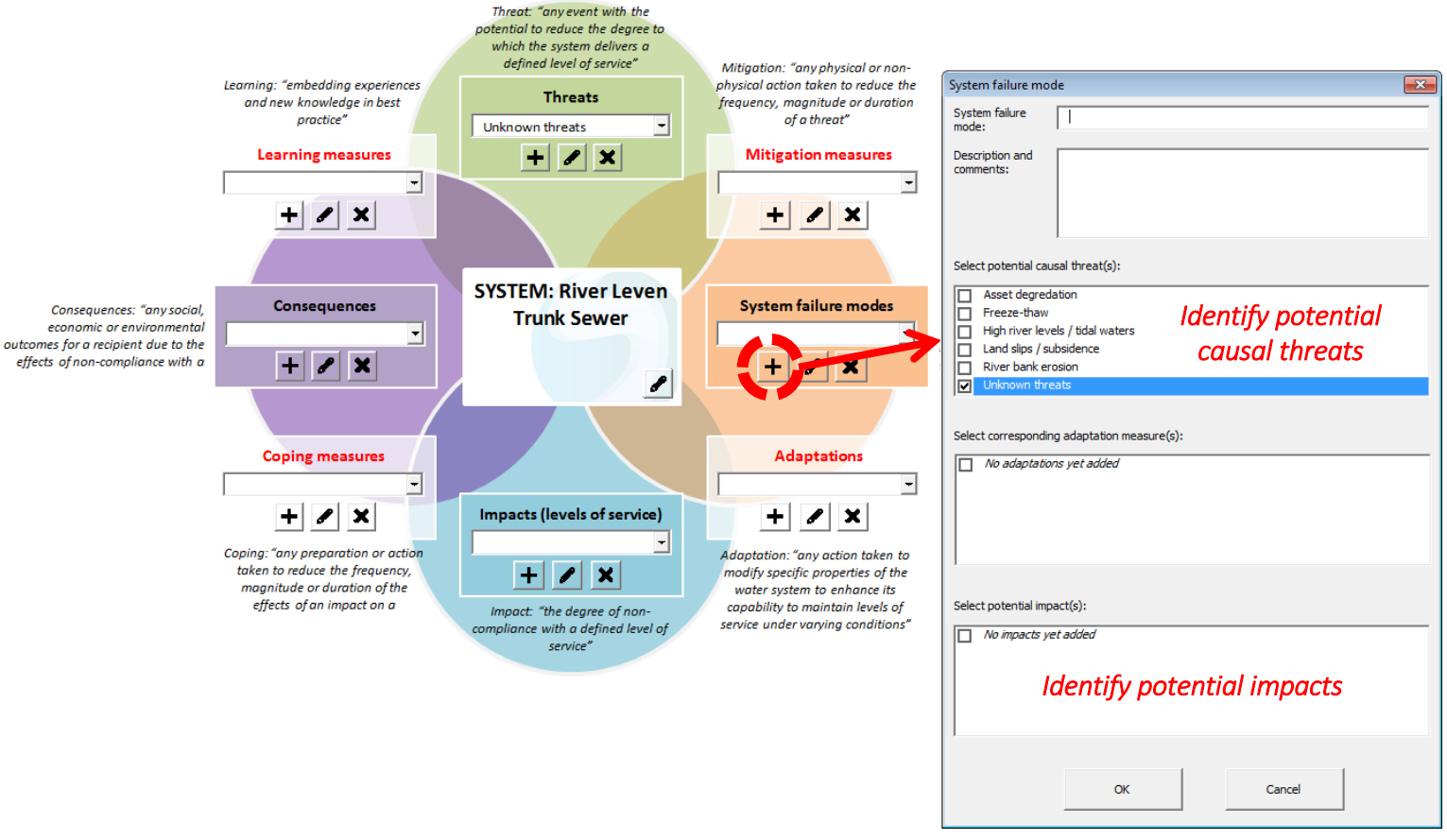
- To provide a better understanding of the relationships between all *threats*, *system failure modes*, *impacts* and *consequences* relevant to the system.
- To aid identification of opportunities / priority areas for intervention.
- To assist in the high-level evaluation and comparison of interventions.

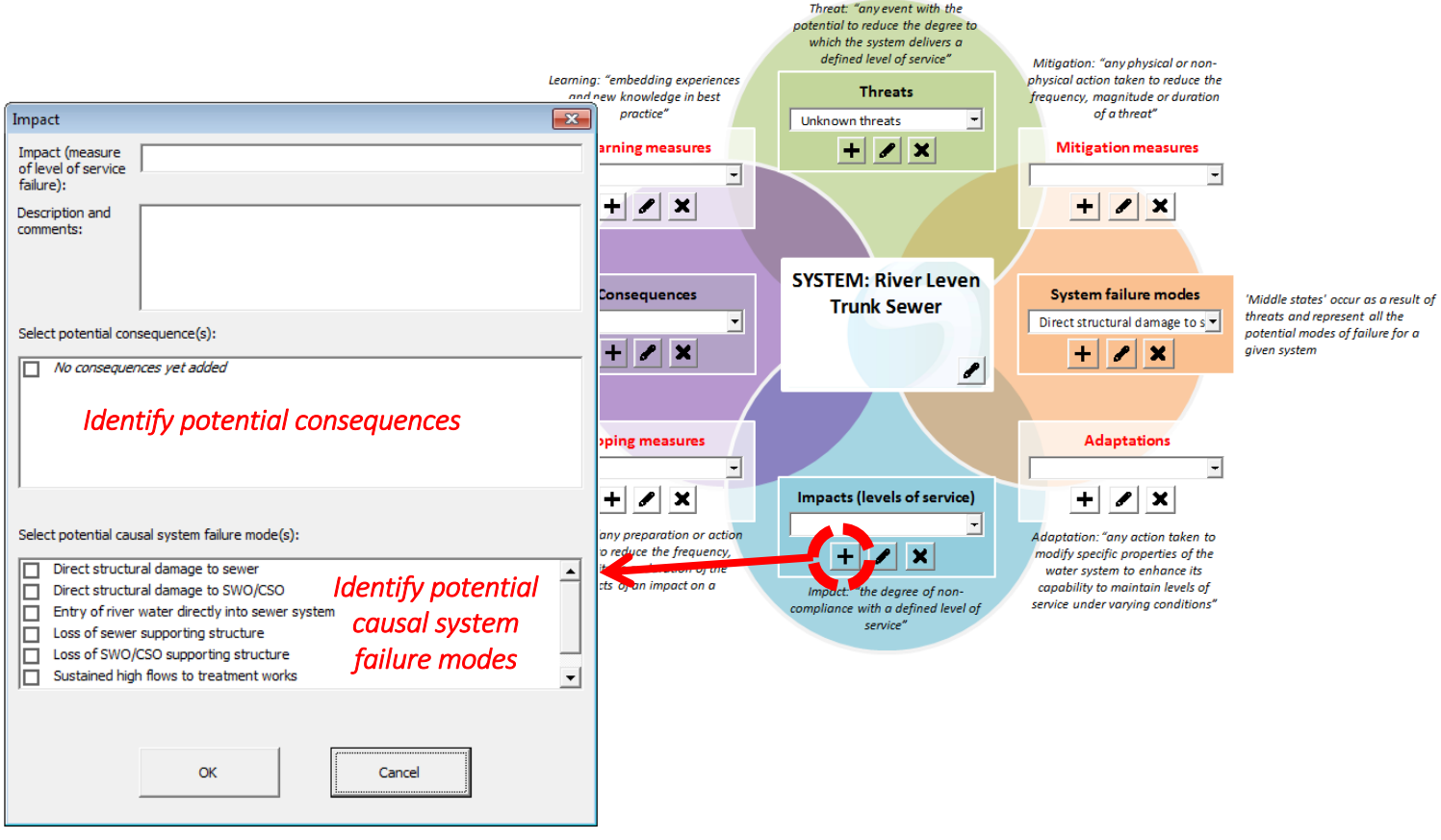

View summary and comparison charts
All learning measures
All theats
All mitigation measures
All consequences
ALL
All system failure modes
All coping measures
All impacts
All adaptations
Safe&SuRe Water management
Guidance Notes
Clear All
View connected elements
Connected components and corresponding interventions for:
Threats, system failure modes, impacts and consequences addressed by:
Selected threat
Selected failure mode
Selected impact
Selected consequence
Selected mitigation measure
Selected adaptation
Selected coping measure
Selected learning measure
Consequences: "any social, economic or environmental outcomes for a recipient due to the effects of non-compliance with a
Threat: "any event with the potential to reduce the degree to which the system delivers a defined level of service"
Learning: "embedding experiences and new knowledge in best practice"
Mitigation: "any physical or non-physical action taken to reduce the frequency, magnitude or duration of a threat"
Threats
Unknown threats
Learning measures
Mitigation measures
Consequences
SYSTEM: Not specified
System failure modes
'Middle states' occur as a result of threats and represent all the potential modes of failure for a given system
Coping measures
Adaptations
Impacts (levels of service)
Coping: "any preparation or action taken to reduce the frequency, magnitude or duration of the effects of an impact on a
Adaptation: "any action taken to modify specific properties of the water system to enhance its capability to maintain levels of service under varying conditions"
Impact: "the degree of non-compliance with a defined level of service"

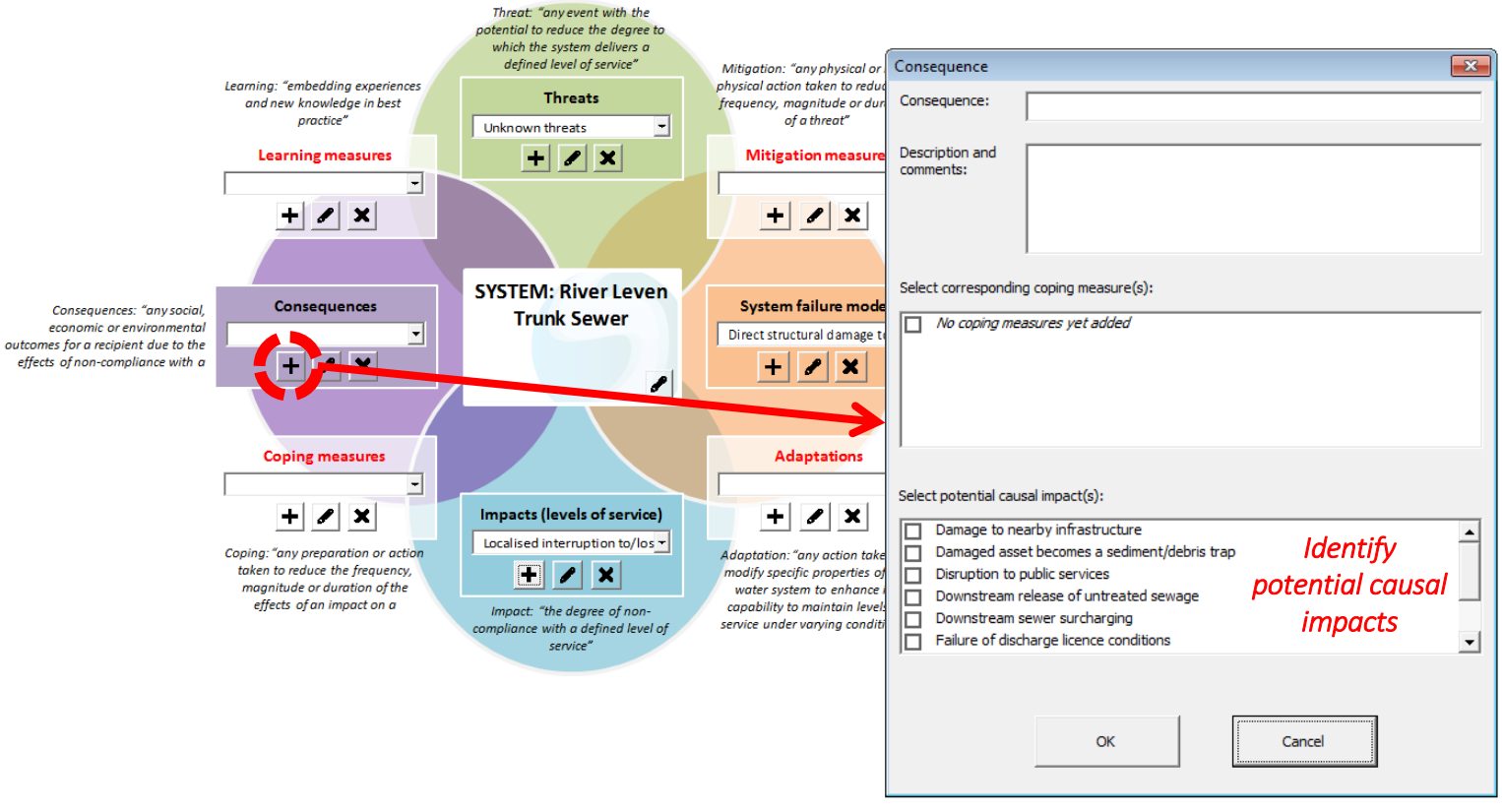
Step 1: Identify and add threats, system failure modes, impacts and consequences






Threat: "any event with the potential to reduce the degree to which the system delivers a defined level of service"
Threats
Unknown threats
Learning: "embedding experiences and new knowledge in best practice"
Learning measures
Mitigation: "any physical or non-physical action taken to reduce the frequency, magnitude or duration of a threat"
Mitigation measures
Consequences: "any social, economic or environmental outcomes for a recipient due to the effects of non-compliance with a
Consequences
SYSTEM: River Leven Trunk Sewer
System failure modes
Coping measures
Coping: "any preparation or action taken to reduce the frequency, magnitude or duration of the effects of an impact on a
Impacts (levels of service)
Impact: "the degree of non-compliance with a defined level of service"
Adaptations
Adaptation: "any action taken to modify specific properties of the water system to enhance its capability to maintain levels of service under varying conditions"
System failure mode
System failure mode:
Description and comments:
Select potential causal threat(s):
Asset degredation
Freeze-thaw
High river levels / tidal waters
Land slips / subsidence
River bank erosion
Unknown threats
Identify potential causal threats
Select corresponding adaptation measure(s):
No adaptations yet added
Select potential impact(s):
No impacts yet added
Identify potential impacts
OK
Cancel


Impact
Impact (measure of level of service failure):
Description and comments:
Select potential consequence(s):
No consequences yet added
Identify potential consequences
Select potential causal system failure mode(s):
Direct structural damage to sewer
Direct structural damage to SWO/CSO
Entry of river water directly into sewer system
Loss of sewer supporting structure
Loss of SWO/CSO supporting structure
Sustained high flows to treatment works
Identify potential causal system failure modes
OK
Cancel
Threat: "any event with the potential to reduce the degree to which the system delivers a defined level of service"
Threats
Unknown threats
Learning: "embedding experiences and new knowledge in best practice"
Mitigation: "any physical or non-physical action taken to reduce the frequency, magnitude or duration of a threat"
Mitigation measures
SYSTEM: River Leven Trunk Sewer
System failure modes
Direct structural damage to s
'Middle states' occur as a result of threats and represent all the potential modes of failure for a given system
Adaptations
Impacts (levels of service)
Impact: "the degree of non-compliance with a defined level of service"
Adaptation: "any action taken to modify specific properties of the water system to enhance its capability to maintain levels of service under varying conditions"


Threat: "any event with the potential to reduce the degree to which the system delivers a defined level of service"
Threats
Unknown threats
Learning: "embedding experiences and new knowledge in best practice"
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Mitigation: "any physical or
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Mitigation measure
Consequences: "any social, economic or environmental outcomes for a recipient due to the effects of non-compliance with a
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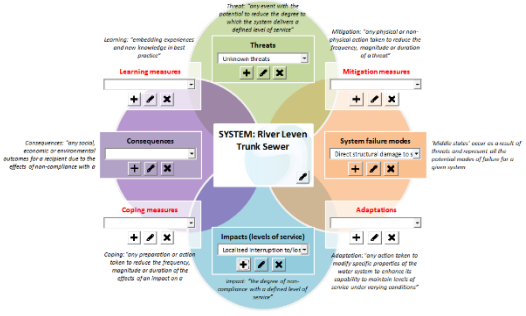
SYSTEM: River Leven Trunk Sewer
System failure mode
Direct structural damage t
Coping measures
Adaptations
Impacts (levels of service)
Localised interruption to/los
Coping: "any preparation or action taken to reduce the frequency, magnitude or duration of the effects of an impact on a
Impact: "the degree of non-compliance with a defined level of service"
Adaptation: "any action take
modify specific properties of
water system to enhance
capability to maintain level
service under varying conditi
Consequence
Consequence:
Description and comments:
Select corresponding coping measure(s):
No coping measures yet added
Select potential causal impact(s):
Damage to nearby infrastructure
Damaged asset becomes a sediment/debris trap
Disruption to public services
Downstream release of untreated sewage
Downstream sewer surcharging
Failure of discharge licence conditions
Identify potential causal impacts
OK
Cancel

Threats

- *River bank erosion*
- *High river levels / tidal waters*
- *Landslips / subsidence*
- *Freeze-thaw*
- *Asset degradation*

Consequences

- *Pollution of river environment*
- *Visual pollution*
- *Financial costs*
- *Reputational damage*
- *Flooding of land and property*
- *Alteration of river course*
- *Further scouring/undermining of assets*
- *Health and safety concerns*



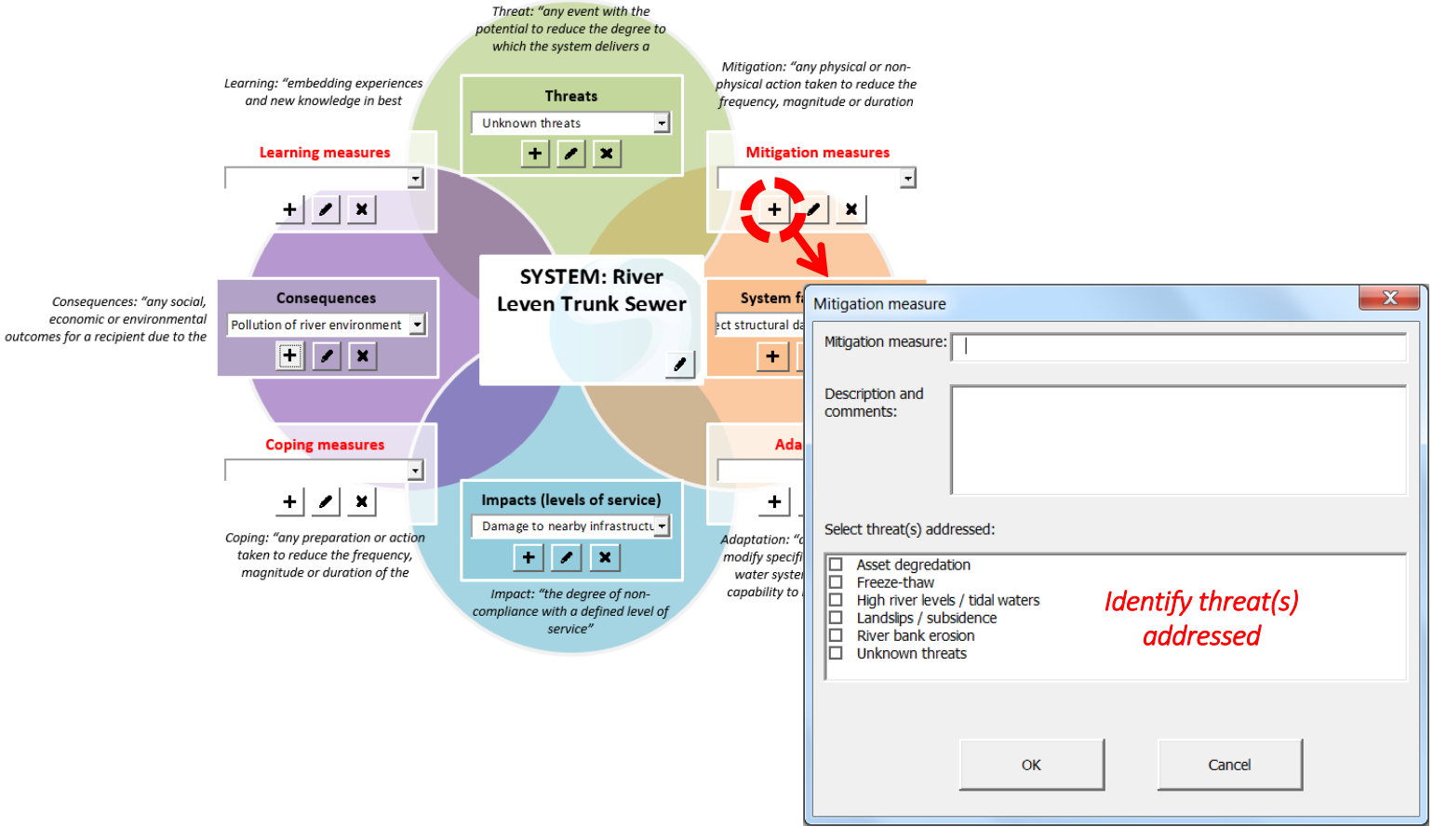
System failure modes

- *Direct structural damage to sewer*
- *Loss of sewer supporting structure*
- *Direct structural damage to SWO/CSO*
- *Loss of SWO/CSO supporting structure*
- *Entry of river water directly into sewer system*
- *Unauthorised operation of CSOs*
- *Sustained high flows to treatment works*

Impacts

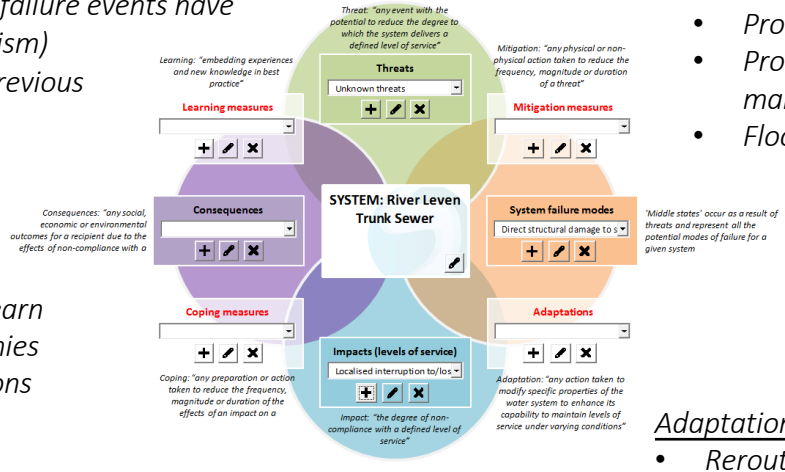
- *Localised interruption to / loss of drainage service*
- *Release of untreated sewage to the environment*
- *Damage to nearby infrastructure*
- *Disruption to public services*
- *Damaged asset becomes a sediment / debris trap*
- *Failure of storm flow / final effluent licence conditions*
- *Downstream sewer surcharging*

Step 2: Add possible interventions (mitigations measures, adaptations, coping measures and learning measures)



Learning

- *Where else has similar risk been identified?*
- *Learn from how previous failure events have occurred (failure mechanism)*
- *Learn from response to previous failure events*
- *Learn from previous use of grey or green engineering for bank stabilisation*
- *Communicate with and learn from other water companies*
- *Identify innovative solutions employed by others*



Mitigation

- *Bank stabilisation*
- *Land management*
- *Proactive monitoring*
- *Proactive asset inspection and maintenance*
- *Flood warnings*

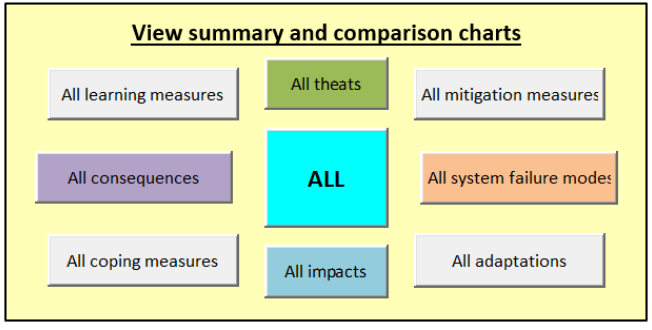
Coping

- *Contingency plans*
- *Response and recovery plans*
- *Aeration of watercourse*
- *Manual removal of sedimentation*
- *Fail and fix solutions*

Adaptation

- *Rerouting trunk sewer away from river*
- *Raising trunk sewer above river*
- *Reinforcement or protection of assets*
- *Reactive asset inspection*
- *Add redundancy in network, e.g. bypass sewer*

Step 3: View summary and comparison charts

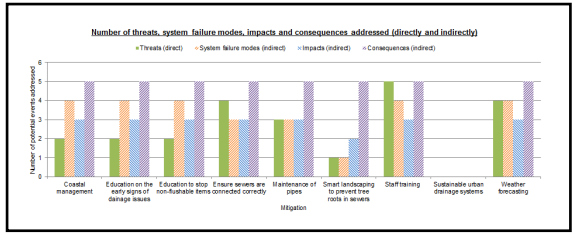


<u>Threats / system failure modes / impacts / consequences:</u>

- Which are addressed by the fewest interventions?
- Which has the fewest or most potential resultant events?
- Which has the fewest or most potential causal events?

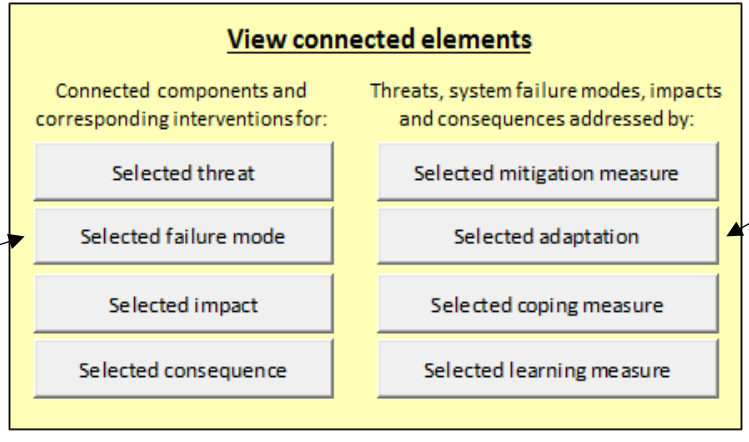
<u>Mitigation / adaptation / coping / learning measures:</u>

- Which addresses the most threats / system failure modes / impacts / consequences?



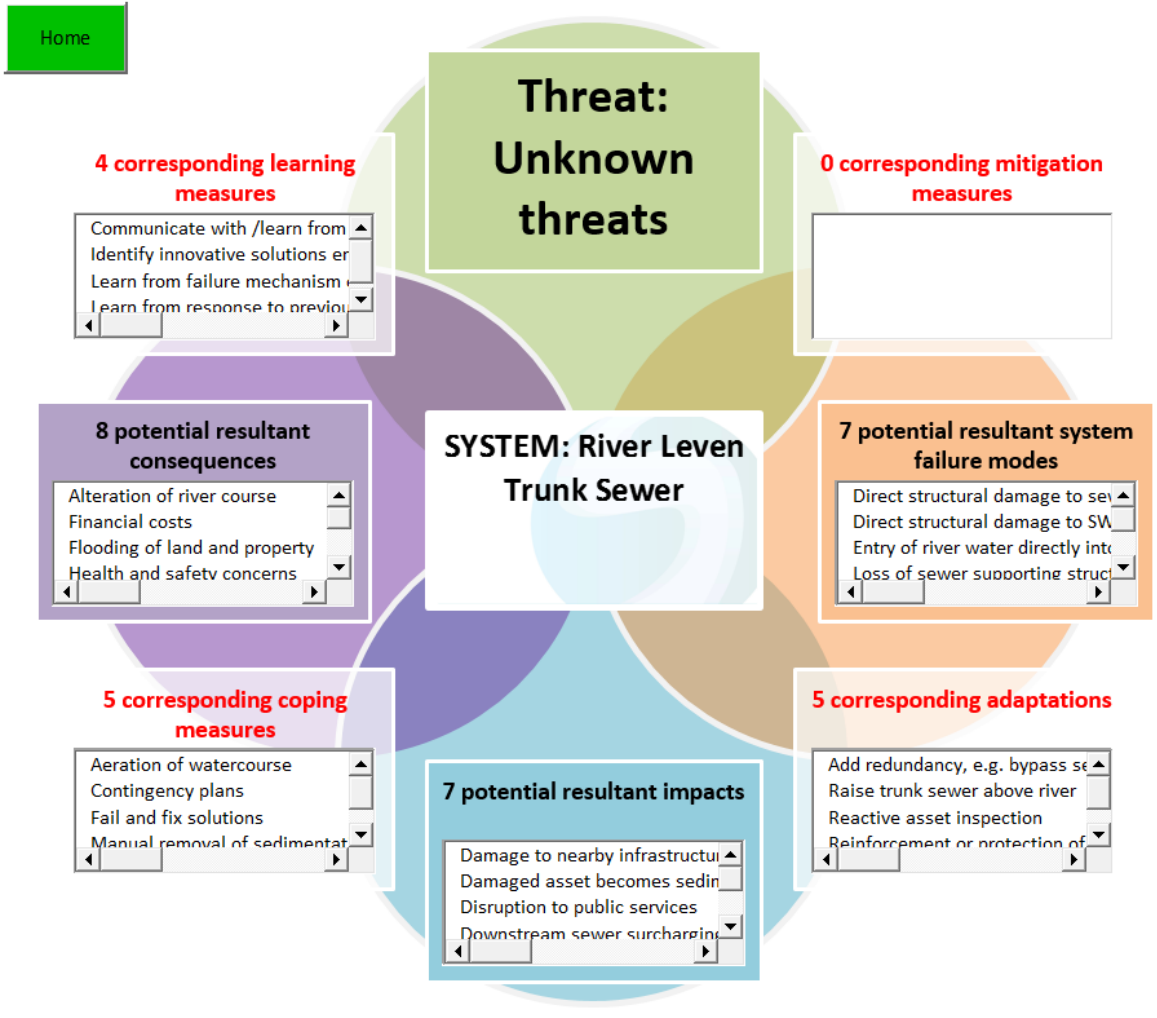
Step 4: View connected elements

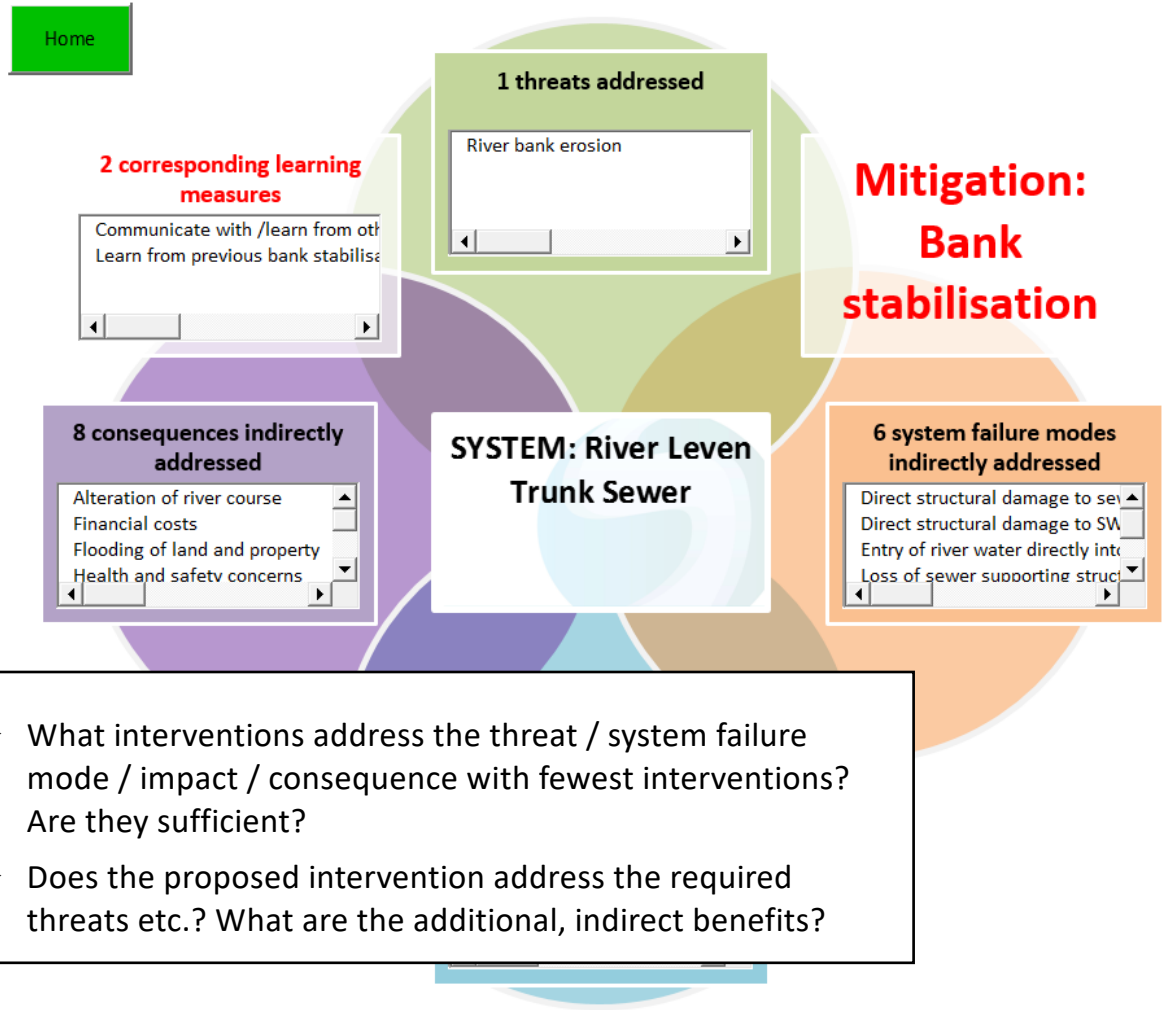
Links to view connected components and corresponding interventions for threat / system failure mode / impact / consequence currently selected in drop down menu



Links to view threats, system failure modes, impacts and consequences addressed by intervention currently selected in drop down menu

E.g. elements connected to selected threat, directly and indirectly





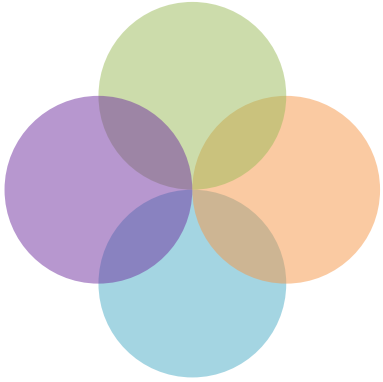
E.g. elements addressed by selected mitigation, directly and indirectly

- What interventions address the threat / system failure mode / impact / consequence with fewest interventions? Are they sufficient?
- Does the proposed intervention address the required threats etc.? What are the additional, indirect benefits?

Next steps…

- Resilience Challenges

- Unclear terminology
- Measurement
- Cost
- Realising benefits



+ Resilience Benefits

- Multiple benefits
- Strategic ambition
- Reputation
- Climate ready